Template assisted formation of ultrasmall bimetallic nanoparticles with precise number of atoms using $M_{12}L_{24}$ nanospheres

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Ultrasmall nanoparticles (<5 nm) show a variety of potential applications in the fields of biomedicine, opto-electronics and catalysis due to their unique properties. Different synthetic techniques have been proposed to prepare such nanoparticles, and the key challenge is to prevent Ostwald ripening which thermodynamically favors large particles. In addition, it is difficult to obtain and maintain a narrow distribution of uNPs.[1,2] Motivated by these challenges we were interested in the development of supramolecular strategies for the template assisted formation of uNPs. Herein, we demonstrate a supramolecular strategy to pre-organize iridium and rhodium complexes in a $M_{12}L_{24}$ nanosphere for the formation of small, well-defined nanoparticles consisting of 24 atoms.

Nanoparticles composed of these two metals in different ratios were examined as catalysts in the catalytic hydrogenation of styrene. High catalytic activity and stability were observed using the encapsulated nanoparticles which exceeded the corresponding non-encapsulated nanoparticles. In addition, the stability of the nanoparticle, represented as TON_{max}, can be optimized by changing the ratio of the rhodium and iridium atoms of the nanoparticle. Based on high resolution-imaging and light scattering, we propose that this encapsulation provides both unprecedented control and stabilization of ultrasmall nanoparticles.

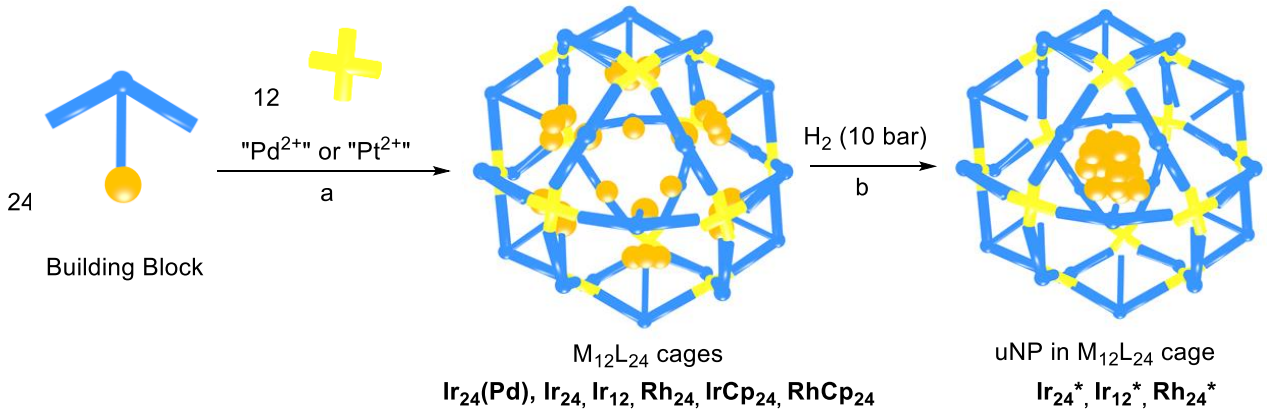

Figure 1 Schematic Representation of the strategy.

References

[1] C. N. R. Rao, G. U. Kulkarni, P. J. Thomas, and P. P. Edwards, *Chem. Soc. Rev.*, 2000, **29**, 27–35.
[2] C.-J. Jia and F. Schüth, *Phys. Chem. Chem. Phys.*, 2011, **13**, 2457.

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